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10/608,083	06/27/2003	Nicolas Bruno	302692.01	8078

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2166	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/10/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

PTOL-90A (Rev. 10/06)

	Application No.	Applicant(s)
Office Action Summary	10/608,083	BRUNO ET AL.
	Examiner	Art Unit	
	Srirama Channavajjala	2166	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>11 December 2006</u>.

2a)☐ This action is **FINAL.**   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-61</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) <u>1-61</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on <u>27 June 2003</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

        1.☐ Certified copies of the priority documents have been received.

        2.☐ Certified copies of the priority documents have been received in Application No. _____.

        3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

Response to RCE

1.   Claims 1-61 are presented for examination.

2.   Claims 1,23,45-46,54 have been amended [12/11/2006].

3.   A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11 December 2006 has been entered, Office action is as follows

4.   Examiner acknowledges applicant's amendment filed on 7/25/2006.

Drawings

5.   The Drawings filed on 6/27/2003 are <u>acceptable</u> for examination purpose.

Information Disclosure Statement

6.   The information disclosure statement filed on 8/29/2003 is in compliance with the provisions of 37 CFR 1.97, and has been considered and a copy was enclosed with previous Office Action mailed on 1/25/2006.

Double Patenting

7.   In view of applicant's filing "*terminal disclaimer*" on 7/25/2006, the non statutory double patent rejection as set forth in the previous office action is hereby withdrawn.

Specification

8.   Specification is objected to: At page 7-8, 24,applicant incorporated U.S. Patent
Application Serial No. 10/191,822. Applicant is hereby required to update the status of
the US application in response to this office action.

9.   Applicant has incorporated by reference US Application 10/191,822, at
page 7-8,24, Examiner notes that incorporation by reference of an application in a
printed United States patent constitutes a special circumstance under 35 U.S.C. § 122
warranting that access of the original disclosure of the application be granted. The
incorporation by reference will be interpreted as a waiver of confidentiality of only the
original disclosure as filed, and not the entire application file, In re Gallo, 231 USPQ 496
(Comm'r Pat. 1986). If Applicant objects to access to the entire application file, two
copies of the information incorporated by reference must be submitted along with the
objection. Failure to provide the material within the period provided will result in the
entire application (including prosecution) being made available to petitioner. The Office
will not attempt to separate the noted materials from the remainder of the application.
Compare In re Marsh Engineering Co., 1913 C.D. 183 (Comm'r Pat. 1913).

Claim Rejections - 35 USC § 112

10.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11.   Claims 1-61 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

12.   The metes and bound of the method steps of claim 1,23,45 are unclear. In claim 1, 23,45, the steps of "expressing the query", "determining", "if the query is not separable", "recursively performing", "matching any conditional selectivity expression", "combining the selectivity values " are indefinite as they lack concrete active limitations as to how the steps are to be accomplished. One of skill in the art would not be able to determine what exactly must be done to accomplish the goal of the preamble. It is unclear how the "determine a selectivity value for each query selectivity factor" is calculated, but it appears that it merely performing recursively steps (b-c), furthermore, what is meant by "query selectivity factor"?

13.   The limitation of claim 2,24, does not appear to be a further process step and does not appear to further limit the method of claim 1,23, It is unclear which "estimated selectivity" related to cardinality of the query? Because claim 1 recites "estimated selectivity values obtained in step e) to estimate the selectivity of the query.

14.   It is unclear where to add the limitations of claim 3,25, to the method of

claim 1,23. It is unclear which "product of query selectivity factors" reference different

sets of a database tables?

15.   In claim 4, 26,50, it is unclear what "query selectivity factor" means in relation to

the methods of claim 1,3.

16.   The limitations of claim 5,27,51, are not directed to "approximating number of

tuples returned by a database query" as set forth in claim 1, but appears to be a

limitation of "non-separable query selectivity". It is not clear what "non-separable query

selectivity" means in relation to the methods of claim 1 particularly "decomposed into a

single conditional selectivity expression results".

17.   In claim 6,28, it is unclear what is meant by "estimated selectivity" in relation to

the methods of claim 1,23,

18.   In claim 7,29, It is unclear which "estimated selectivity" related to approximate the

number of tuples returned by the query.

19.   In claim 8,30,52,60, contain the same problems of "selectivity value", the steps of

the claims do not meet the goal of the preamble of the independent claim. In claim

8,30,52,60 what is meant by "statistic matched with the conditional selectivity expression" in relation to the error with the estimated selectivity value?

20. Claims 9,31,53,61 each depend from claim 8,30,52,60 respectively and contain the same problem.

21. In claims 10,32, how does the "stored statistics comprises histograms"?, similar problem exist in claims 22,44 "histograms built over computed columns ".

22. In claims 11,33, it is unclear what "compiling a set of candidate statistics" means in relation to the methods of claim 1,23.

23. In claims 12,34,47,55, it is unclear what "least number of independence assumptions" means in relation to the "compiling a set of candidate statistics" in claim 11,33, and how does one identify "least number of independence assumptions "according to the method? The limitation lacks positive active steps to be taken in the execution of the method. Similar problems exist in claims 13,35,48,56 and 14,36,49,57.

24. In claim 15,37, it is unclear what "generate alternative products" means in relation to the "conditional selectivity expression". Similar problem exist in claim 16-17,38-39.

25.   In claim 18,40, The limitations are not directed to approximating a number of tuples returned by a database query as set forth in the claim 1 preamble, but appears to be a limitation of query is disjunctive. Therefore, the steps of the claims do not meet the goal of the preamble of the independent claims. One must question the query is disjunctive based on predicates.

26.   In claims 19,41, it is unclear what "method steps to return a number of distinct values" means in relation to the methods of claim 1. The limitation lacks positive active steps to be taken in the execution of the method. Similar problems exist in claims 20-21, 42-43.

27.   Further, in claim 45, Applicant appear to be invoking 112 sixth paragraph "means for" type language, but it is unclear what structures are being used to perform the functions. No particular structures are identified in the specification that would perform the function. The claim does not require any database, hardware, software, input, output etc., The claims merely require "approximating a number of tuples returned by a database query" and means for manipulating the "approximating a number of tuples returned by a database query". One of skill in the art would not be apprised of what structures are intended to be encompassed by the claims. Nor would it be clear what the structures are intended to accomplish.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

28. **Claims 1-61 are rejected under 35 U.S.C. 101 because invention is directed to non-statutory subject matter.**

As set forth in MPEP 2106(II)A:

*Identify and understand Any Practical Application Asserted for the Invention. The claimed invention as a whole must accomplish a practical application. That is, it must produce a "useful, concrete and tangible result." State Street, 149 F.3d at 1373, 47USPQ2d at 1601-02. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of "real world" value, as opposed to subject matter that represents nothing more than an idea or concept, or is simply a starting point for future investigation or research (Brenner v. Manson, 383 U.S. 519, 528-36, 148 USPQ 689, 693-96); In re Ziegler, 992, F.2d 1197, 1200-03, 26 USPQ2d 1600,1603-06 (Fed. Cir. 1993)). Accordingly, a complete disclosure should contain some indication of the **practical application** for the claimed invention, i.e., why the applicant believes the claimed invention is useful.*

*Apart from the utility requirement of 35 U.S.C. 101, usefulness under the patent eligibility standard requires significant functionality to be present to satisfy the useful result aspect of the practical application requirement. See Arrhythmia, 958 F.2d at 1057, 22 USPQ2d at 1036. Merely claiming nonfunctional descriptive material **stored in a***

computer-readable medium does not make the invention eligible for patenting.
*For example, a claim directed to a word processing **file stored on a disk may satisfy
the utility** requirement of 35 U.S.C. 101 since the information stored may have some
"real world" value. However, the mere fact that the claim may satisfy the utility
requirement of 35 U.S.C. 101 **does not mean that a useful result is achieved under
the practical application requirement. *The claimed invention as a whole must
produce a "useful, concrete and tangible" result to have a practical application****.

29.   Regarding claims 1,23,45, "A method for approximating a number of tuples
returned by a database query that comprises a set of predicates that each reference a
set of database tables, the method comprising the steps of:

   a) expressing the query as a query selectivity;

   b) determining if the query is separable and if so separating the query selectivity
   to form a product of query selectivity factors;

   c) if the query is not separable, atomically decomposing the query selectivity to
   form a product that comprises a conditional selectivity expression;

   e) matching any conditional selectivity expression with stored statistics to obtain
   statistics that can estimate the selectivity of the conditional selectivity
   expressions and using the statistics to obtain an estimated selectivity value; and

   f) combining the selectivity values obtained in step d) and the estimated
   selectivity values obtained in step e) to estimate the selectivity of the query"

is directed to "abstract idea" because all of the elements in the claim 1,23,45 would

reasonably be interpreted by one of ordinary skill in light of the disclosure page 8-

14,page 16, page 19-21,page 23-24, 28-29, 32-34,page 35-36, as software [merely

algorithm], such that the method is software, per se , is "non-statutory subject matter"

[see Interim Guidelines page 55-57] and *claim 1,23,45* do not have "practical

application" because the "final result" by the claimed invention in the claim 1, 23,45

elements particularly "*c) if the query is not separable, atomically decomposing the*

query selectivity to form a product that comprises a conditional selectivity

expression;

> *e) matching any conditional selectivity expression with stored statistics to*
>
> *obtain statistics that can estimate the selectivity of the conditional*
>
> *selectivity expressions and using the statistics to obtain an estimated*
>
> *selectivity value; and*

f) combining the selectivity values obtained in step d) and the estimated

selectivity values obtained in step e) to estimate the selectivity of the query"

is not producing "useful, and concrete" results or output and therefore, claim 1, 23,45,

is a non-statutory subject matter [see Interim Guidelines page 55-57]. The claimed

invention is subject to the test of State Street, 149 F.3d at 1373-74, 47 USPQ2d at

1601-02. Specifically State Street sets forth that the claimed invention must produce a

"useful, concrete and tangible result." The Interim Guidelines for Examination of Patent

Applications for Patent Subject Matter Eligibility states in section IV C. 2 b. (2)

(on page 21 in the PDF format):

The tangible requirement does not necessarily mean that a claim must either be tied to a particular machine or apparatus or must operate to change articles or materials to a different state or thing. However, the tangible requirement does require that the claim must recite more than a § 101 judicial exception, in that the process claim must set forth a practical application of that § 101 judicial exception to produce a real-world result. Benson, 409 U.S. at 71-72, 175 USPQ at 676-77 (invention ineligible because had "no substantial practical application.").

[If] Claim 1, 23,45 have the result of producing results related to "*c) if the query is not separable, atomically decomposing the query selectivity to form a product that comprises a conditional selectivity expression;*

  e) matching any conditional selectivity expression with stored statistics to obtain statistics that can estimate the selectivity of the conditional selectivity expressions and using the statistics to obtain an estimated selectivity value; and

f) combining the selectivity values obtained in step d) and the estimated selectivity values obtained in step e) to estimate the selectivity of the query" however the claim[s] do not specify [a]: satisfying proper condition[s]; [b] that the result neither stored , or output or at least displayed to a user or otherwise used in the real world, but merely combining the selectivity values........."

The examiner reviewed the specification disclosure page 8-14,page 16, page 19-21,page 23-24, 28-29, 32-34,page 35-36 but was unable to find a practical real-world use of the result (*c) if the query is not separable, atomically decomposing the query selectivity to form a product that comprises a conditional selectivity expression;*

e) matching any conditional selectivity expression with stored statistics to

obtain statistics that can estimate the selectivity of the conditional

selectivity expressions and using the statistics to obtain an estimated

selectivity value; and

f) combining the selectivity values obtained in step d) and the estimated

selectivity values obtained in step e) to estimate the selectivity of the query")

If the applicant is able to find one and inserts it into the claims provide the

location the element is found in the specification

Claims 2-22,24-44 depend from claims 1,23 is also rejected in the above

analysis.

30.   Regarding claims 46,54, "A method for approximating a number of tuples

returned by a database query that comprises a set of predicates that each reference a

set of database tables, the method comprising the steps of:

a) expressing the query as a query selectivity;

b) determining if the query is separable and if so separating the query selectivity by

separating the predicates that reference different sets of database tables to form a

product of query selectivity factors that reference that reference different sets of

database tables;

c) if the query is not separable, repeatedly decomposing the query selectivity to form a

product that comprises a conditional selectivity expression to generate alternative

products and wherein one of those products is selected to estimate the selectivity of the

query;

d) recursively performing steps b)-c) to determine a selectivity value for each query

selectivity factor;

e) matching any conditional selectivity expression with stored statistics to obtain

statistics that can estimate the selectivity of the conditional selectivity expressions by:

i) compiling a set of candidate statistics that can be used to estimate the selectivity of

the conditional selectivity expression;

ii)selecting candidate statistics to estimate the selectivity of the conditional selectivity

expression based on a selection criteria; and

iii)using the statistics to obtain an estimated selectivity value" is directed to "abstract

idea" because all of the elements in the claim 46,54, would reasonably be interpreted

by one of ordinary skill in light of the disclosure page 8-14,page 16, page 19-21,page

23-24, 28-29, 32-34,page 35-36, as software [merely algorithm], such that the method

is software, per se , is "non-statutory subject matter" [see Interim Guidelines page 55-

57] and **claim 46,54,** do not have "practical application" because the "final result" by

the claimed invention in the claim 46,54, elements particularly **"e) matching any**

conditional selectivity expression with stored statistics to obtain statistics that

can estimate the selectivity of the conditional selectivity expressions by:

i) compiling a set of candidate statistics that can be used to estimate the

selectivity of the conditional selectivity expression;

ii)selecting candidate statistics to estimate the selectivity of the conditional

selectivity expression based on a selection criteria; and

iii)using the statistics to obtain an estimated selectivity value"

is not producing "useful, and concrete" results or output and therefore, claim 46,54,

is a non-statutory subject matter [see Interim Guidelines page 55-57]. The claimed

invention is subject to the test of State Street, 149 F.3d at 1373-74, 47 USPQ2d at

1601-02. Specifically State Street sets forth that the claimed invention must produce a

"useful, concrete and tangible result." The Interim Guidelines for Examination of Patent

Applications for Patent Subject Matter Eligibility states in section IV C. 2 b. (2)

(on page 21 in the PDF format):

> The tangible requirement does not necessarily mean that a claim must either be tied to a particular machine
> or apparatus or must operate to change articles or materials to a different state or thing. However, the
> tangible requirement does require that the claim must recite more than a § 101 judicial exception, in that the
> process claim must set forth a practical application of that § 101 judicial exception to produce a real-world
> result. Benson, 409 U.S. at 71-72, 175 USPQ at 676-77 (invention ineligible because had "no substantial
> practical application.").

[If] Claim 46,54, have the result of producing results related to " *e) matching any*

conditional selectivity expression with stored statistics to obtain statistics that

can estimate the selectivity of the conditional selectivity expressions by:

i) compiling a set of candidate statistics that can be used to estimate the

selectivity of the conditional selectivity expression;

ii)selecting candidate statistics to estimate the selectivity of the conditional

selectivity expression based on a selection criteria; and

iii)using the statistics to obtain an estimated selectivity value"

however the claim[s] do not specify [a]: satisfying proper condition[s]; [b] that the result

neither stored , or output or at least displayed to a user or otherwise used in the real

world, but merely compiling ....selectivity value.

The examiner reviewed the specification disclosure page 8-14,page 16, page

19-21,page 23-24, 28-29, 32-34,page 35-36 but was unable to find a practical real-world

use of the result (*e) matching any conditional selectivity expression with stored*

statistics to obtain statistics that can estimate the selectivity of the conditional

selectivity expressions by:

i) compiling a set of candidate statistics that can be used to estimate the

selectivity of the conditional selectivity expression;

ii)selecting candidate statistics to estimate the selectivity of the conditional

selectivity expression based on a selection criteria; and

iii)using the statistics to obtain an estimated selectivity value")

If the applicant is able to find one and inserts it into the claims provide the

location the element is found in the specification

Claims 47-53,55-61 depend from claims 46,54 is also rejected in the above

analysis.

For "General Analysis for Determining Patent-Eligible Subject Matter", see 101
Interim Guidelines as indicated below:

<<http://www.uspto.gov/web/offices/pac/dapp/ogsheet.html>>

see MPEP 8th edition, Rev 5, Aug 2006

No new matter should be entered.

Claim Rejections - 35 USC § 102

31.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a
foreign country or in public use or on sale in this country, more than one year
prior to the date of application for patent in the United States.

32.   ***Claims 1-18, 22-40, 44-61 are rejected under 35 U.S.C. 102(b) as being***

anticipated by Nicolas Bruno [hereafter Bruno] "Automatic management of

statistics on Query expressions in relational database", Ph.D Thesis Proposal,

department of computer science, Columbia University, NY, published on April 25,

2002.

33.   As to claim 1, 23,45, Bruno teaches a system which including 'approximating a

number of tuples returned by a database query that comprises a set of predicates that

each reference a set of database tables' [page 1, line 4-7], Bruno discusses query

optimizers specifically using base tables having attributes, tuple[s] are integral part of

any relational base tables because each row of the table represents at least one tuple ,

cardinality is the number of tuples in a relation, and search condition corresponds to

predicate [page 1, line 12-13], page 4, fig 2.2];

'(a)expressing the query as a query selectivity' [page 4, example 1, fig 2.2 a-b],

Bruno suggests query optimizer for example as detailed in fig 2.2, specifically directed

to query selectivity using relational operators in the query optimizer as detailed in

fig 2.2;

' (b) determining if the query is separable and if so separating the query

selectivity to form a product of query selectivity factors' [page 5, 2.2.1, example 2,

page 6, line 1-3], Bruno specifically teaches selection queries having multiple predicates

for example as detailed inn page 5, "SELECT * FROM R

WHERE R.a > 10 AND R..b < 100

Where the selectivity for the whole predicate is estimated as detailed in page 6,

line 1-2;

'(c) if the query is not separable, atomically decomposing the query selectivity to

form a product that comprises a conditional selectivity expression' [page 9, 3.2.2,

fig 3.1], Bruno specifically teaches various predicates for example equality join,

conjunctive [see fig 3.1b], join predicates, further for a given query, the decomposing

query into possible sub queries, it is also noted that Bruno specifically suggests using

"well-know algorithm" not only in selection condition of "q", but also rewriting exclusively

used for cardinality estimation and not for plan generation, during query optimization,

"S" is treated as "base table" specifically statistics on columns having single name,

values , therefore, atomically decomposing the query is integral part of Bruno's

teaching;

'(d) recursively performing steps b)-c) to determine a selectivity value for each

query selectivity factor' [page 5, line 10-14, page 6, 2.2.2 , fig 2.4];

'(e) matching any conditional selectivity expression with stored statistics to obtain

statistics that can estimate the selectivity of the conditional selectivity expressions and

using the statistics to obtain an estimated selectivity value' [page 6, 2.2.2, line 12-22,

fig 2.4, page 14, example 4, fig 4.1];

'(f) combining the selectivity values obtained in step (d) and the estimated

selectivity values obtained in step (e) to estimate the selectivity of the query' [page 15,

line 6-18, fig 4.1-4.2].

34.   As to claim 46, 54, Bruno teaches a system which including 'approximating a

number of tuples returned by a database query that comprises a set of predicates that

each reference a set of database tables' [page 1, line 4-7], Bruno discusses query

optimizers specifically using base tables having attributes, tuple[s] are integral part of

any relational base tables because each row of the table represents at least one tuple ,

cardinality is the number of tuples in a relation, and search condition corresponds to

predicate [page 1, line 12-13], page 4, fig 2.2];

'(a)expressing the query as a query selectivity' [page 4, example 1, fig 2.2 a-b],

Bruno suggests query optimizer for example as detailed in fig 2.2, specifically directed

to query selectivity using relational operators in the query optimizer as detailed in

fig 2.2;

' (b) determining if the query is separable and if so separating the query

selectivity by separating the predicates that reference different sets of database tables

to form a product of query selectivity factors that reference different sets of database

tables' [page 5, 2.2.1, example 2,   page 6, line 1-3], Bruno specifically teaches

selection queries having multiple predicates for example as detailed inn page 5,

"SELECT * FROM R

    WHERE R.a > 10 AND R..b < 100

Where the selectivity for the whole predicate is estimated as detailed in page 6,

line 1-2;, database tables corresponds to Bruno's base tables,

'(c) if the query is not separable, repeatedly atomically decomposing the query

selectivity to form a product that comprises a conditional selectivity expression to

generate alternative products and wherein one of those products is selected to estimate

the selectivity of the query' [page 9, 3.2.2, fig 3.1], Bruno specifically teaches various

predicates for example equality join, conjunctive [see fig 3.1b], join predicates, further

for a given query, the decomposing query into possible sub queries; it is also noted that

Bruno specifically suggests using "well-know algorithm" not only in selection condition

of "q", but also rewriting exclusively used for cardinality estimation and not for plan

generation, during query optimization, "S" is treated as "base table" specifically statistics

on columns having single name, values , therefore, atomically decomposing the query

is integral part of Bruno's teaching;

'(d) recursively performing steps b)-f) to determine a selectivity value for each

query selectivity factor' [page 5, line 10-14, page 6, 2.2.2 , fig 2.4];

'(e) matching any conditional selectivity expression with stored statistics to obtain

statistics that can estimate the selectivity of the conditional selectivity expressions

[page 6, 2.2.2, line 12-22, fig 2.4, page 14, example 4, fig 4.1];

i) 'compiling a set of candidate statistics that can be used to estimate the

selectivity of the conditional selectivity expression' [page 12, 3.3, line 1-13], conditional

selectivity expression corresponds to SQL query as given in line 9-13];

ii) 'selecting candidate statistics to estimate the selectivity of the conditional

selectivity expression based on a selection criteria' [page 12, line 9-13]

iii) 'using the statistics to obtain an estimated selectivity value'[page 12, line 14-

15]

35.   As to claim 2,24, Bruno disclosed 'multiplying the estimated selectivity by a

Cartesian product of the tables referenced by the predicates to obtain a cardinality of

the query' [page 4, fig 2.2], Cartesian product corresponds to joining two tables for

example see SQL statement in fig 2.2 [a].

36.   As to claim 3,25, Bruno disclosed 'separating the query selectivity is performed

by separating the predicates that reference different sets of database tables to form a

product of query selectivity factors that reference different sets of database tables'

[page 5, 2.2.1, page 6, 2.2.3, see SQL statement particularly directed to selection

queries having multiple predicates on different attributes of the table;

37.   As to claim 4-5,26-27, 50-51, 58-59, Bruno disclosed 'step c) further comprises a

query selectivity factor and wherein steps b)-f) are recursively performed to determine a

selectivity value for the query selectivity factor in step c) [page 5, line 10-14, page 6, 2.2.2 , fig 2.4];

38.   As to claim 6,28, Bruno disclosed 'storing the estimated selectivity of the query obtained in step f) in memory' [page 7, line 5-11].

39.   As to claim 7, 29, Bruno disclosed 'estimated selectivity is stored for a query and returning that value to approximate the number of tuples returned by the query' [page 7, line 14-17].

40.   As to claim 8,30, 52, 60, Bruno disclosed 'error with the estimated selectivity value that is based on an accuracy with which the statistic matched with the conditional selectivity expression can estimate the selectivity of the conditional selectivity expression' [page 8, line 1-4, page 9, 3.2].

41.   As to claim 9,31, 53, 61, Bruno disclosed 'error associated with each conditional selectivity expression to obtain an estimated error for the selectivity estimation for the query' [page 9, 3.3.2, line 1-7].

42.   As to claim 10,32, Bruno disclosed 'statistics comprise histograms on results of previously executed query expression' [page 5, fig 2.3, 2.2.1].

43.   ·As to claim 11, 33, Bruno disclosed 'matching the conditional selectivity

expressions with stored statistics is performed by compiling a set of candidate statistics

that can be used to estimate the selectivity of the conditional selectivity expression'

[page 12, 3.3, line 1-13], conditional selectivity expression corresponds to SQL query as

given in line 9-13]; 'selecting candidate statistics to estimate the selectivity of the

conditional selectivity expression based on a selection criteria' [page 12, line 9-13]

44.   As to claim 12,34, 47, 55, Bruno disclosed 'selection criteria for a candidate

statistic is determined by computing a number of independent assumptions that are

made when the candidate is used to estimate the selectivity of the conditional selectivity

expression and the selection criteria is to select the candidate that results in the least

number of independence assumptions' [page 10, line 1-16, example 3].

45.   As to claim 13,35, 48, 56, Bruno disclosed 'selection criteria for a candidate

statistic is determined by comparing the candidate statistic with a base statistic over the

same column as the candidate statistic and assigning a difference value to the

candidate statistic based on a level of difference between the candidate statistic and the

base statistic' [page 13, 4.1, line 1-9,page 14, line 7-13].

46.   As to claim 14,36, 49, 57, Bruno disclosed 'compiling a set of candidate statistics

is performed by including statistics that are on results of queries having the same tables

referenced by the conditional selectivity expression or a subset of the tables referenced

by conditional selectivity expression [page 13, 4.2, line 1-6], 'the same predicates over

the tables referenced in the conditional selectivity expression or a subset of the

predicates over the tables referenced in the conditional selectivity expressions'

[page 14, 4.2, line 7-17].

47.   As to claim 15,37, Bruno disclosed 'decomposing the query selectivity and

matching the conditional selectivity expressions are repeated to generate alternative

products and wherein one of those products is selected to estimate the selectivity of the

query' [page 15, line 14-16,page 16, line 5-10].

48.   As to claim 16,38, Bruno disclosed 'decomposing the query is done by

exhausting every alternative way of decomposing the query [page 16, line 4-10]

49.   As to claim 17,39, Bruno disclosed 'decomposing the query selectivity to form

products of conditional selectivity expressions is performed based on an optimizer

search strategy' [page 16, line 11-19].

50.   As to claim 18,40, Bruno disclosed 'query is disjunctive and comprising the step

of transforming the disjunctive predicates into conjunctive predicates by performing a

De Morgan transformation on the disjunctive query' [page 4, fig 2.2, example 1], fig 2.2

a-b represent nodes connected with the same operator for example either conjunction

[equivalent to AND operator] or disjunction [equivalent to OR operator] , further De

Morgan's law supports inverts logical comparison operators for example reversing

logical AND or OR operators where necessary and common knowledge in relational

database art.

51.   As to claim 22,44, Bruno disclosed 'statistics comprise histograms built over

computed columns in a query result' [page 5, 2.2.1, fig 2.3].

Claim Rejections - 35 USC § 103

52.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

53.   **Claims 19-21,41-43 are rejected under 35 U.S.C. 103(a) as being**

unpatentable over *Nicolas Bruno [hereafter Bruno] "Automatic management of*

statistics on Query expressions in relational database", Ph.D Thesis Proposal,

department of computer science, Columbia University, NY, published on April 25,

2002 as applied above 1,23 claims further in view of Acharya et al. [hereafter

Acharya], US Patent No. 6477534 filed on Jan 11,2000, published on Nov 5,2002.

54.   As to claim 19,41, Bruno does not specifically disclosed 'query comprises a

GROUP BY predicate over a grouping column and wherein the query is transformed

prior to performance of the method steps to return a number of distinct values in the

grouping column', although Bruno specifically teaches query plan with various

predicates for example conjunctive, [see fig 3.1 b], equality join predicates, join

predicates and like [page 9, 3.2.1]. On the other hand, Acharya disclosed query

comprises a GROUP BY predicate over a grouping column and wherein the query is

transformed prior to performance of the method steps to return a number of distinct

values in the grouping column' [col 27, line 36-46, fig 10c].

It would have been obvious to one of the ordinary skill in the art at the time of

applicant's invention to incorporate the teachings of Acharya et al. into automatic

management of statistics on query expressions in relational databases of Bruno

because both Acharya, Bruno directed to optimizing query in relational databases

[see Bruno: chapter 2, page 3, 2.1; Acharya: col 8, line 61-67], both are directed to

query workload [see Bruno: page 20, fig 5.1; Acharya: col 8, line 9-14], and both are

directed to statistics on query [Bruno: page 8; Acharya: Abstract] and are from same

field of endeavor.

One of the ordinary skill in the art at the time of applicant's invention to incorporate the teachings of Acharya et al. into automatic management of statistics on query expressions in relational databases of Bruno because that would have allowed users of Bruno to use GROUP BY predicate to avoid overheads of query optimization as suggested by Acharya col 27, line 33-35], further allows to add extra column to each join set relation i.e., query is rewritten to include the extra column group-by-column in the aggregate operator, thus bringing the advantages of generating high-confidence error bounds for the approximate answers, and an efficient maintenance technique for maintaining the statistical summaries in the presence of updates to the database [Acharya: col 5, line 42-47]

.similarly, Claims 20-21, 42-43 are rejected in the above analysis.

Response to Arguments

55.   Applicant's arguments filed on 7/25/2006 with respect to claims 1-61 have been

fully considered but they are not persuasive, for examiners' response see the

discussion below:

a)   At page 16, claims 1,23,45, applicant argues that Bruno fails to disclose or

suggest utilizing conditional selectivity as a framework to identify and exploit SITs which

are useful for cardinality estimates.

        As to the above argument [a], firstly, Bruno is directed to automatic management

of statistics on query expressions in relational databases, more specifically, propagating

statistical information through the query plan [see Abstract, page I, line 1-3]; secondly,

Bruno teaches "statistics on query expressions" particularly, introducing the concept of

statistics on query expressions to eliminate the errors during propagation of the plan

operators [page 8, line 1-7], thirdly, Bruno specifically defining the "multi-attribute

statistics [page 8, line 12], lastly, Bruno clearly disclosed "a framework to exploit SITs"

that is significant use in accurate cardinality estimation for query plans or query

optimization as detailed in page 8, 3.1, conditional selectivity corresponds to any

slectprojectjoin query or SPJ [see page 6-7, 2.2.3, fig 2.5], therefore, as best

understood by the examiner, Bruno specifically teaches utilizing conditional selectivity

as a framework to identify and exploit Sits which are useful cardinality estimates

[see fig 3.1]

b)   At page 17, claim 1, applicant argues that Bruno fails to disclose or suggest

steps b) and c) of claim 1, or any concept of conditional selectivity whatsoever"

c)   At page 18, claim 1,23,45, applicant argues that Bruno does not disclose or

suggests atomically decomposing the query selectivity.

        As to the argument [b-c] as best understood by the examiner, Bruno specifically

teaches selection queries having multiple predicates for example as detailed inn page 5,

"SELECT * FROM R

        WHERE R.a > 10 AND R..b < 100

 Where the selectivity for the whole predicate is estimated as detailed in page 6,

line 1-2;, database tables corresponds to Bruno's base tables, particularly, satisfying if

s_a is the selectivity for R.a > 10 and s_b is the selectivity for R.b < 100 determines the

selectivity to form a product of query selectivity factors and Bruno specifically teaches

various predicates for example equality join, conjunctive [see fig 3.1b], join predicates,

further for a given query, the decomposing query into possible sub queries; it is also

noted that Bruno specifically suggests using "well-know algorithm" not only in selection

condition of "q", but also rewriting exclusively used for cardinality estimation and not for

plan generation, during query optimization, "S" is treated as "base table" specifically

statistics on columns having single name, values , therefore, atomically decomposing

the query is integral part of Bruno's teaching.

examiner above arguments to depend claims 2-18,22,24-40,44,47-53

d)   At page 19-20, claims 19-21,41-43, applicant argues that Bruno and Acharya et

al. fail to disclose or suggests all of the elements of claims 1 and 23.

As to the above argument [d], as best understood by the examiner, both Bruno

and Acharya directed to optimizing query in relational databases [see Bruno: chapter 2,

page 3, 2.1; Acharya: col 8, line 61-67], both are directed to query workload [see Bruno:

page 20, fig 5.1; Acharya: col 8, line 9-14], and both are directed to statistics on query

[Bruno: page 8; Acharya: Abstract] and are from same field of endeavor. It is however,

noted that Bruno does not specifically disclose "GROUP BY" predicate, although Bruno

specifically suggests "query plan" having query with various predicates for example

conjunctive [see fig 3.1b]. On the other hand, Acharya disclosed "GROUP BY"

predicate at col 27, line 36-46, fig 10c. Therefore, ordinary sill in the database art at the

time of applicant's invention to incorporate the teachings of Acharaya into Bruno's

statistics on query expressions in relational databases" because that would have

allowed users of Bruno to use various predicates in "cardinality estimation" and query

plan or optimize to avoid overheads of query optimization as suggested by Acharaya

col 27, line 33-35.

Conclusion

The prior art made of record

   a.   Nicolas Bruno "Automatic management of statistics

on Query expressions in relational database, published on April 25, 2002

   b.   US Patent. No. 6477534

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Srirama Channavajjala whose telephone number is

571-272-4108. The examiner can normally be reached on Monday-Friday from

8:00 AM to 5:30 PM Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Alam, Hosain, T, can be reached on (571) 272-3978. The fax phone

numbers for the organization where the application or proceeding is assigned is

571-273-8300 Information regarding the status of an application may be obtained

from the Patent Application Information Retrieval (PAIR) system. Status information for

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Should you have questions on access to the Private PAIR system, contact the

Electronic Business Center (EBC) at 866-217-9197 (toll-free)

sc
Patent Examiner.
December 28, 2006.   SRIRAMA CHANNAVAJJALA
                              PRIMARY EXAMINER